91-56

ENGLISH BRITAIN B 258

Laurence et al

1853

121/84

ENGLISH

1 sh
8 pp

9/56

A.D. 1853. Jan. 21. No. 258.
LAWRENCE, DAVISON & LAWRENCE'S SPECIFICATION.

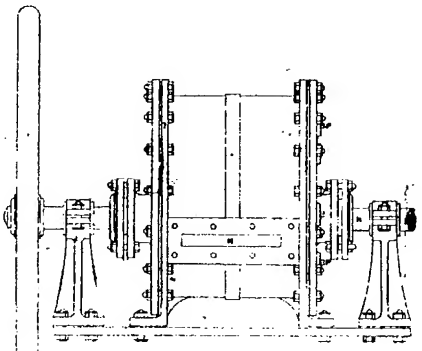


FIG. 1.

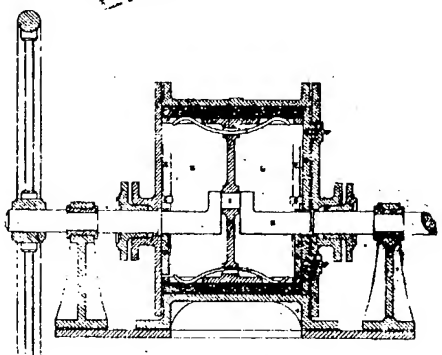


FIG. 2.

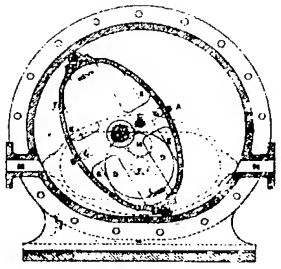


FIG. 3.

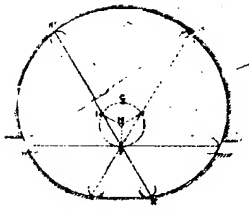


FIG. 4.

cardioid ?
epicycloid

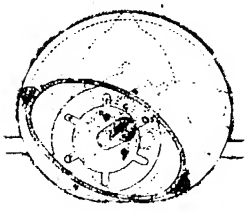


FIG. 5.

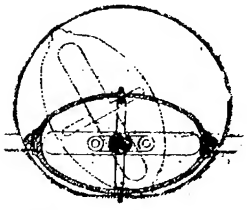


FIG. 6.

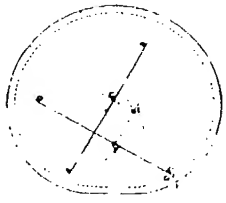
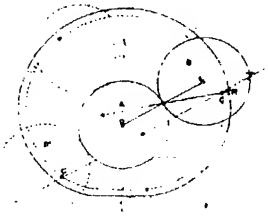


FIG. 8.

FIG. 7.



A.D. 1853 . . . . . N° 258.

Engines to be Worked by Steam or other Fluid.

LETTERS PATENT to Frederick Lawrence, of the City Iron Works, Pitfield Street, in the County of Middlesex, William Davison, of Halstead, in the County of Essex, and Alfred Lawrence, of the City Iron Works, Pitfield Street, in the County of Middlesex, for the Invention of "IMPROVEMENTS IN ENGINES TO BE WORKED BY STEAM OR OTHER FLUID."

Sealed the 22nd July 1853, and dated the 31st January 1853.

PROVISIONAL SPECIFICATION left by the said Frederick Lawrence, William Davison, and Alfred Lawrence at the Office of the Commissioners of Patents, with their Petition, on the 31st January 1853.

We, FREDERICK LAWRENCE, of the City Iron Works, Pitfield Street, in the County of Middlesex, WILLIAM DAVISON, of Halsted, in the County of Essex, and ALFRED LAWRENCE, of the City Iron Works, Pitfield Street, in the County of Middlesex, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN ENGINES TO BE WORKED BY STEAM OR OTHER FLUID" to be as follows:—

The Invention consists of employing a vessel, the interior of which is of the form known as epicycloidal or cardioidal which possesses the property of all chords being equal which pass through a certain point or focus, or of such like form which possesses or approximates to such property. Within this vessel a piston revolves about the point through which the equal chords pass, such piston giving motion either to a crank in the interior, or giving motion directly to an axle at the focus.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Frederick Lawrence, William Davison, and Alfred Lawrence in the Great Seal Patent Office on the 29th July 1853.

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, FREDERICK LAWRENCE, of the City Iron Works, Pitfield Street, in the County of Middlesex, WILLIAM DAVISON, of Halstead, in the County of Essex, and ALFRED LAWRENCE, of the City Iron Works, Pitfield Street, in the County of Middlesex, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Thirty-first day of January, in the year of our Lord One thousand eight hundred and fifty three, in the sixteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Frederick Lawrence, William Davison, and Alfred Lawrence, Her special licence that we, the said Frederick Lawrence, William Davison, and Alfred Lawrence, our executors, administrators, and assigns, or such others as we, the said Frederick Lawrence, William Davison, and Alfred Lawrence, our executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention

for "IMPROVEMENTS IN ENGINES TO BE WORKED BY STEAM OR OTHER FLUID," upon the condition (amongst others) that we, the said Frederick Lawrence, William Davison, and Alfred Lawrence, by an instrument in writing under our hands and seals, or under the hand and seal of one of us, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Frederick Lawrence, on behalf of myself and the said William Davison and Alfred Lawrence, do hereby declare the nature of the said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof (that is to say):

The Invention consists of employing a vessel, the interior of which is of the form known as epicycloidal or cardioidal, which possess the property of all chords being equal which pass through a certain point or focus, or of such like form which possesses or approximates to such property. Within this vessel a piston revolves about the point through which the equal chords pass, such piston giving motion either to a crank in the interior, or giving motion directly to an axle at the focus. And in order that my said Invention may be most fully understood, and readily carried into effect, I will proceed to describe the Drawings.

Figures 1, 2, 3, shew an engine of the proposed construction. Figure 1, is an elevation; Figure 2, longitudinal section, shewing piston in a vertical position; Figure 3, cross section. The letters in each Figure refer to the same parts. A, the cylinder bored of the form shewn, which is a cardiode or epicycloidal curve, in which all chords passing through the point F, or focus, are equal; B, B, the piston formed with guide sides E, E, to clasp the disc D, D, which is fixed to the sides of the cylinder at the focus F, thus compelling the centre line K, K¹, of piston during its revolution always to pass through F; G, the centre of the cylinder, at which there is a stud or pin; H, the main axle, the centre of which is placed

equidistant from F, and C, having the crank H, I, upon it. The connecting pin I, works in a bush at the centre of piston, as shewn in the two sections. At certain positions of the piston the pin or guide C, fixed on the sides of the cylinder at the centre, works in small slots G, G, in the piston, as shewn by the red dotted lines serving as a guide in those positions where the disc D, D, does not act to advantage. The ends of piston are thus always made to touch the form of cylinder, N, M, steam and eduction pipes respectively. The action of the engine is as follows:—The steam entering at N, exerts a pressure on the whole of the piston K, K^1, thus compelling it to revolve round the point F, in the direction of the arrow, with a power proportioned to the difference between the portions K, F, and F, K^1, on each side of the fixed point F, giving motion by its revolution to the crank H, I, and main axle H, every revolution of the piston causing the crank and axle to revolve twice. When the piston reaches the position shewn by the red dotted lines, the steam ceases to exert power, the portions of piston on either side of F being equal, and the crank axle is at its "dead point." The axle is propelled past this point either by a balanced wheel, as shewn in Drawing, or by a piston at right angles working on the same shaft in another cylinder, so that when the piston in one cylinder is at its dead point, the piston in the other is in the most advantageous position. The round ends or packing of the piston K, K^1, are made to work steam-tight with the cylinder by springs L, L, or other means. The packing at the sides of the cylinder is accomplished by a moveable plate O, O, which is moved forward by springs or bolts P, P, to allow for wear. The peculiar motion of the piston produces a nearly uniform wear of the sides. Figure 4, is a diagram to illustrate the motion of the piston and crank during a revolution; F, the focus, a point so situate that all chords passing through it are equal, and through which the axis K, K^1, of piston is made to pass by means of the guides before described; H, main axle; I, connecting pin of crank; C, centre of curve; K, K^1, piston. The red and black full and dotted lines shew the various positions of the piston and crank during a revolution. Figure 5, shews another method

of guiding the piston so that its axis may always pass through the focus; F, focus as before, at which there is a pin or stud; H, main axle; H, I, crank; C, centre of cylinder; R, S, two pins placed in the circle described by centre of crank pin I, and equidistant from one another and the focus F; T, T, T, six short grooves in the piston B, B. One of the three pins R, S, and F, is always in one or other of the grooves T, T, one pin never leaving a groove until one of the other pins has entered. The piston in the figure shews the pin S, in its groove, acting as a guide. The black dotted lines shew a position of piston with F as a guide, and the dotted red lines another position with R as the guiding pin. In the above Figure three pins are shewn as guides, but two or four or any number of pins may be used, corresponding grooves being formed in the piston, their centres all being placed in the circle described by centre of connecting pin of crank. Figure 6, shews a method of driving a shaft at the focus F, without the internal crank. The piston B, B, has a groove in the centre, passing over the axle F, and working on wheels attached to axle to prevent friction; C, is a pin at the centre of curve, which acts as a guide to compel the ends of the piston to describe the curve of the cylinder, thereby preventing any friction on the cylinder from the sliding motion of the piston on the axle, the pin C producing that motion, not the curve. The steam compels the piston to revolve as in the previous case, thus giving motion to the axle F. The black dotted lines shew the piston in another position. In all the above engines the steam will work the piston without valves; but should it be required to use the steam expansively, or be considered advantageous, a slide or D valve may be used for cutting off the steam when required, moved by a cam or eccentric on the main shaft, and the motion of the engine may be reversed by altering the position of the valve (as in an ordinary engine) so as to change M into the steam pipe, and N into the eduction pipe. All the preceding arrangements may be applied, if required, to a piston working in a cylinder not a cardiode as shewn, but any other curve approximating to such form or even to a circle; but the departure from the true form or curve, the cardiode, must be

made up by a corresponding elongation or shortening of the piston by means of expanding ends regulated by springs. Figure 7, is a diagram shewing the principle upon which tools for boring or describing the cardioidal or epicycloidal curve for the cylinder can be made; A, a fixed circle; D, E, an arm turning on the point F; B, B, palettes, at right angles to D, E, touching circle A. On turning the arm D, E, round F, the palettes B, B, working on the fixed circle A, guide the arm so as to make it slide through F; and the point G, or any other point on D, E, describes the cardioidal curve. In boring it is necessary that the tool shall, during a revolution, be at right angles to or at the same angle with the surface cut. This is accomplished by another arm J, K, (with palettes B^1, B^1,) passing through F, always being at right angles to D, E, and having a centre I; the line H, G, I, passing through G, & I, is always a normal (that is, at right angles) to the curve described by point H. The point H will, therefore, describe the curve required for an engine with a piston having a round end of equal radius to H, G, and throw of crank equal to C, F, the centre of curb A being the centre of the cylinder. If required a second boring tool or bar may be placed at the other end K of the arm D, E, guided by a bar L, K, I, passing through I, as shewn by black dotted lines. The red dotted lines shew the boring apparatus in another position. Figure 8, shews a second method of boring the curve; A a fixed toothed wheel; B, another toothed wheel of equal diameter, which is made to roll upon A; D, E, arm joining the centres of two wheels A, and B; G, point in the wheel B. The point G, as the wheel B rolls on A, describes the cardioidal curve, as shewn by the dotted curve. In order to make the tool always cut at right angles to the curve I, is a pin fixed on the arm D, E, equidistant between D, and E, which guides the tool by means of the arm H, G, I, turning on G, and passing through the pin I, causing the tool H always to be at right angles to the curve cut. H, will describe the curve required for a cylinder, of which the throw of the working crank is equal to twice E, G, and the radius of the round end of the piston equal to G, H. If required, a second boring tool may be placed at the point

G, on another circle B^1, opposite to B; or curves of various sizes and various eccentricities may be bored by the same apparatus by placing the tools at such points on the line G, G^1, or G, G^1, produced as may be found convenient. When two tools are used they must be equidistant from the centre of line G, G^1. The normal motion for guiding the tool so that it always cuts at right angles to curve may either be produced by a pin I, as before described, or by a guide pin at the centre of a bar always at right angles to G, G^1, worked by a pair of wheels similar to B, and B^1, as indicated by the dotted red lines on Figure 8. Figure 9, shews a third method of boring the curve; F, C, two fixed points respectively at the focus and centre of the curve required; A, B, and D, E, two arms crossing at right angles fixed together; A, B, always passing through C, and D, E, always through F. The point G, on the arm D, E, as the cross A, B, D, E, revolves on the two pins will describe the curve required. The red lines shew a similar cross, the arms of which are respectively parallel to A, B, and D, E, having a pin or guide at I, through which the arm H, G, I, turning on G, always passes. The point H describes the curve required for a piston, with a round end radius equal to H, G; and the tool H is always kept at right angles to the curve cut.

We claim,— Firstly, the application of a cylinder of the form known as a cardiodi or epicycloid for the purpose of producing a rotatory motion in an axle or shaft.

Secondly, the use of a crank in an interior of a cylinder of whatever form worked by the revolution of a piston within the same.

Thirdly, for the various guiding motions described and shewn in the Figures, by which the ends of the piston in the interior of the cylinder are made to describe the curve to which the cylinder is formed.

Fourthly, the various tools for boring a true epicycloidal curve indicated by the Diagrams.

In the above description we have used the word "cylinder" to denote that chamber within which the piston works for the convenience of description; the word cylinder having been long used by engineers

to indicate that part of an engine, though its form be very different from a cylinder.

We propose to apply our Invention as an engine to be worked by steam, water, wind, gas, or any other vapour or fluid (when worked by the wind a cylinder is not necessary).

We also propose to apply such engines to the working of cranes, lifts, or other machinery, either worked by steam, water, air, or gas. Also as a meter for fluids or gases. As a pump for water, air, gas, &c., and for all other purposes to which steam, water, air, or gas engines are now applied.

In witness whereof, I, the said Frederick Lawrence, have hereunto set my hand and seal, this Twenty-ninth day of July, in the year of our Lord One thousand eight hundred and fifty-three.

FREDERICK LAWRENCE. (L.S.)

Witness,
S. CARPMAEL.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1854.